



National Aeronautics and
Space Administration



NASA Ames' **Robotic Exploration of the Moon and Beyond**

March 28, 2017



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National Aeronautics and
Space Administration



NASA Ames Research Center – Silicon Valley



- **Science**
 - Space, Earth, Biological Sciences
 - Astrobiology, Lunar Science
- **Cost-Effective Space Missions**
 - Lunar Exploration
 - Small Spacecraft and Nanosatellites
- **Exploration Systems**
 - Autonomy, and Supercomputing
 - Entry Systems
- **Aeronautics & Aviation**
 - NextGen Air Traffic Management
 - Aviation Safety
- **Innovative & Entrepreneurial Collaborations**
 - NASA Research Park & 90 partners

- **Founded 1939, 2nd oldest NASA center**
- **2500 employees**
w/ another **1200** students in summers
- **\$900M+ yearly budget**



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Ames

Discovery • Innovations • Solutions

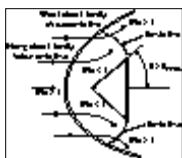


78 Years of Innovation at Ames

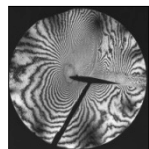
1939 - 2017



Flight
Simulator



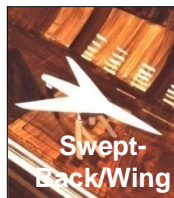
Blunt Body
Concept



Transonic
Flow



Lifting Body



Swept-
Back/Wing



Flight
Research

1950



Arcjet Research



Apollo Heat
Shield Tests



Life Sciences
Research



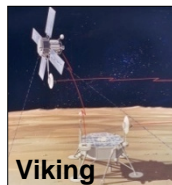
CFD



Pioneer
Venus



Pioneer 10/11



Viking

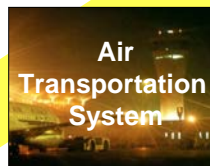
1970



Tiltrotor

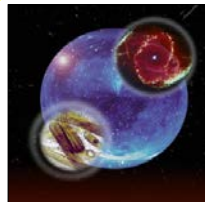


Kuiper Observatory



Air
Transportation
System

1980



Astrobiology



X-36



Galileo



Space
Biology

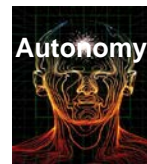
1990



Lunar
Prospector



SSERVI

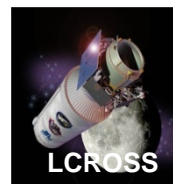


Autonomy



ISS

2000



LCROSS

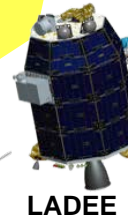


NanoSats



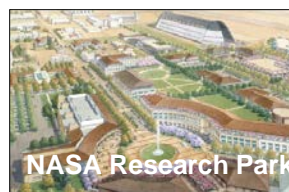
Kepler/K2

2010



LADEE

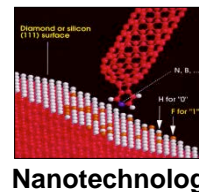
2017



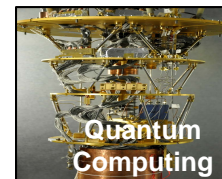
NASA Research Park



SOFIA



Nanotechnology



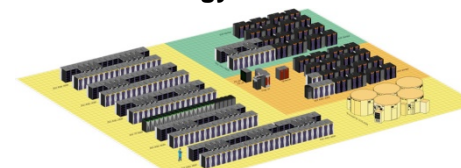
Quantum
Computing



ER-2



Ames Research Center



One of the World's Fastest
Operational Supercomputers

4/14/2017

Hypervelocity Free Flight

Ames Flight of Moon & Beyond



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Kepler / K2 Mission

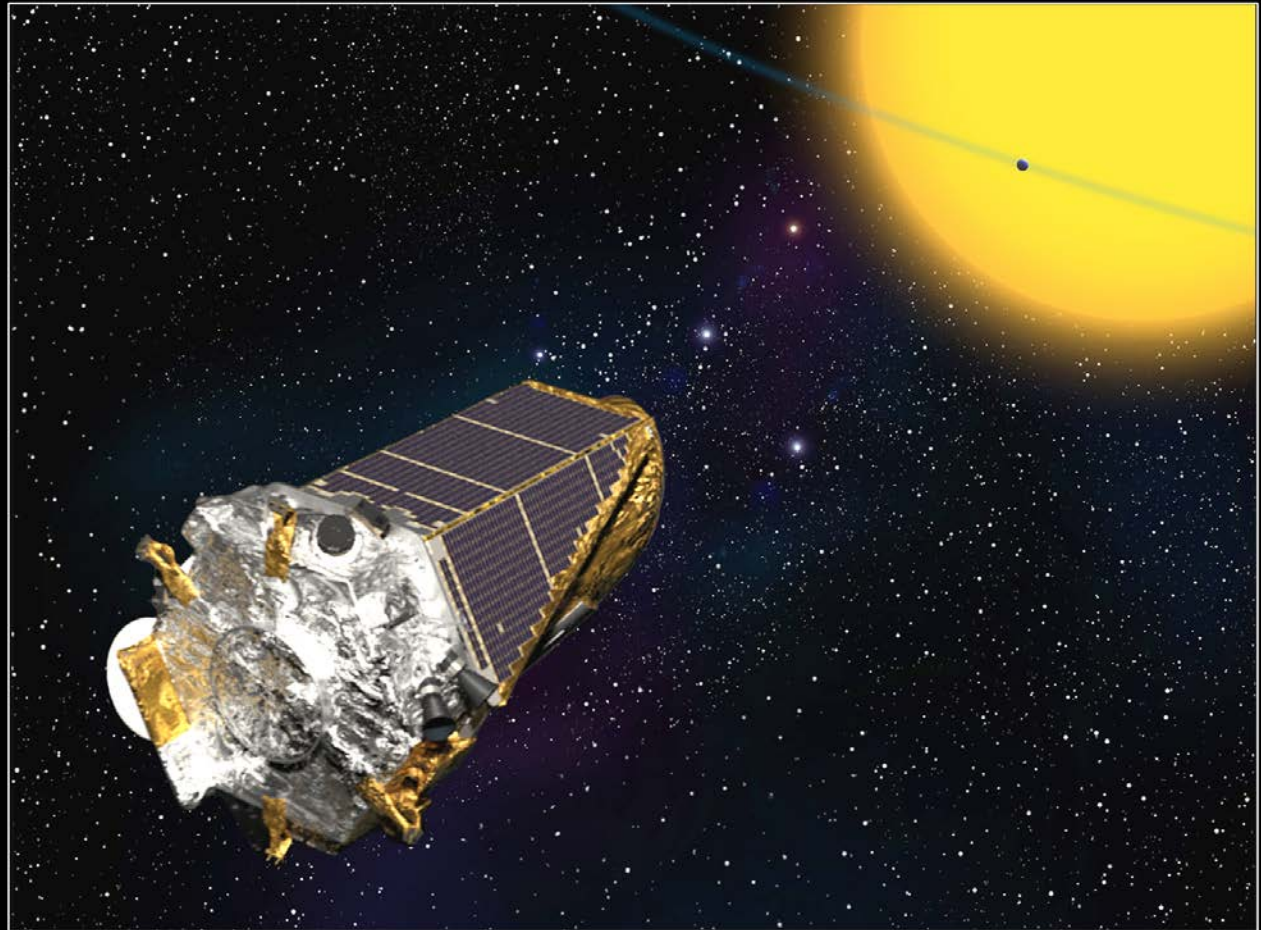
- Find the number of Earth-size and larger planets in the habitable zone of sun-like stars

**Launched:
March 7, 2009**

**Observed
145,000 Stars**

**3461+
Confirmed
Planets**

**4496+
Candidate
Planets
to be confirmed**





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LCROSS Mission

**Lunar CRater Observation
and Sensing Spacecraft**

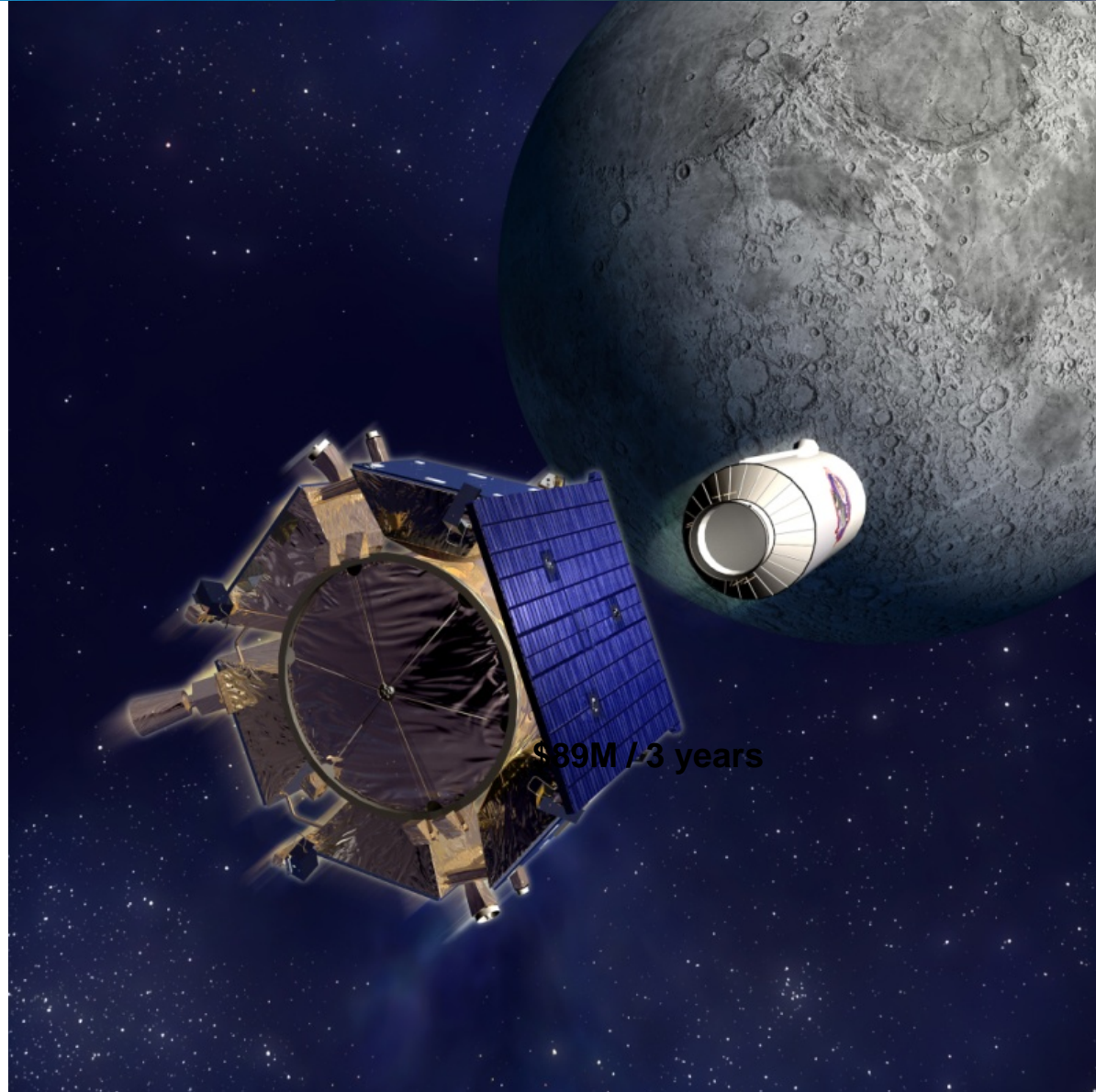
Launched: June 18, 2009

Impacted: October 9, 2009

**Confirmed Water ice in
permanently shadowed
craters on the Moon**

**Demonstrated “Secondary”
launch with another
spacecraft**

**Impacted a “used” empty
rocket and measured the
result**





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LADEE : Lunar Atmosphere and Dust Environment Explorer

**Measure the Lunar Dust and
the Examine the Lunar atmosphere**

- **Launched Sept 6, 2013**
- **Ended on April 18th, 2014**
- **First Composite Small Spacecraft**
- **Demonstrated Laser
Communications from Lunar Orbit**



4/14/2017

Ames' Expl of Moon & Beyond





BioSentinel: Deep-Space Radiation BioSensor

Mission Objectives:

A CubeSat to be launched on NASA's first SLS

- 70 million miles from Earth at 18 months
- Far outside the protective shield of Earth's magnetosphere

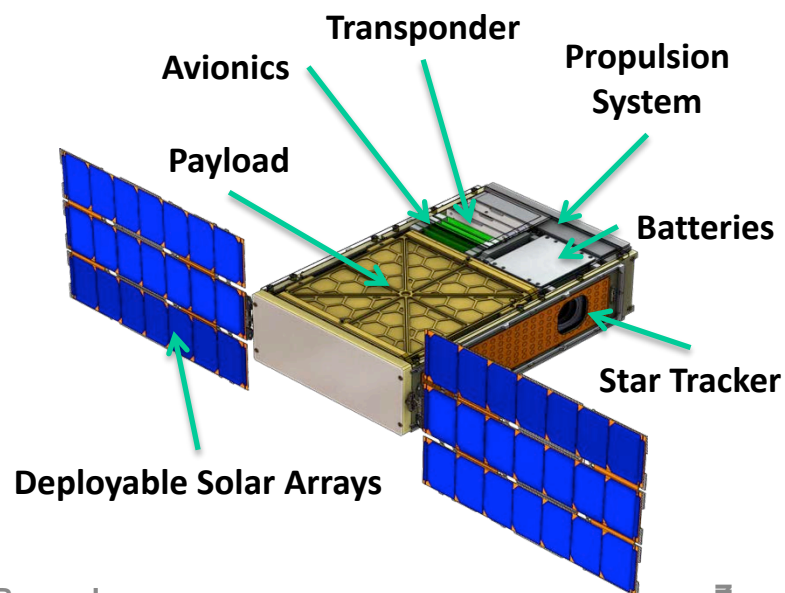
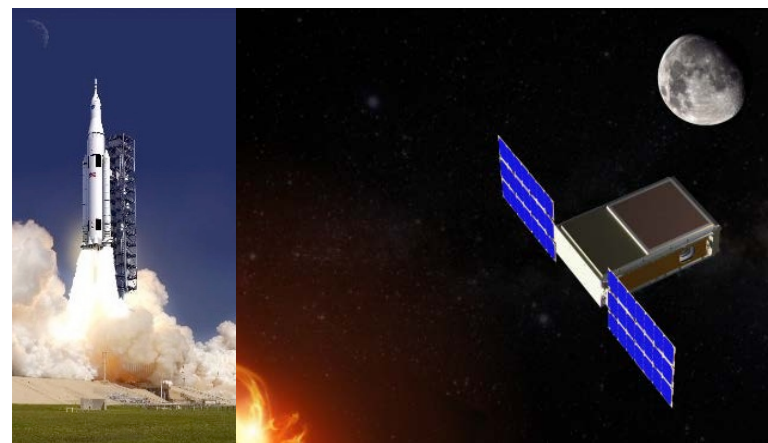
Conduct life science studies relevant to human exploration

- 1st biological study beyond LEO in over 40 years
- Uses Yeast DNA as a BioSensor

Design payload with sensors for multiple environments

- Instrument on ISS at similar time to SLS launch
- Ground controls in lab and at radiation beam facilities

Expected Launch in 2019



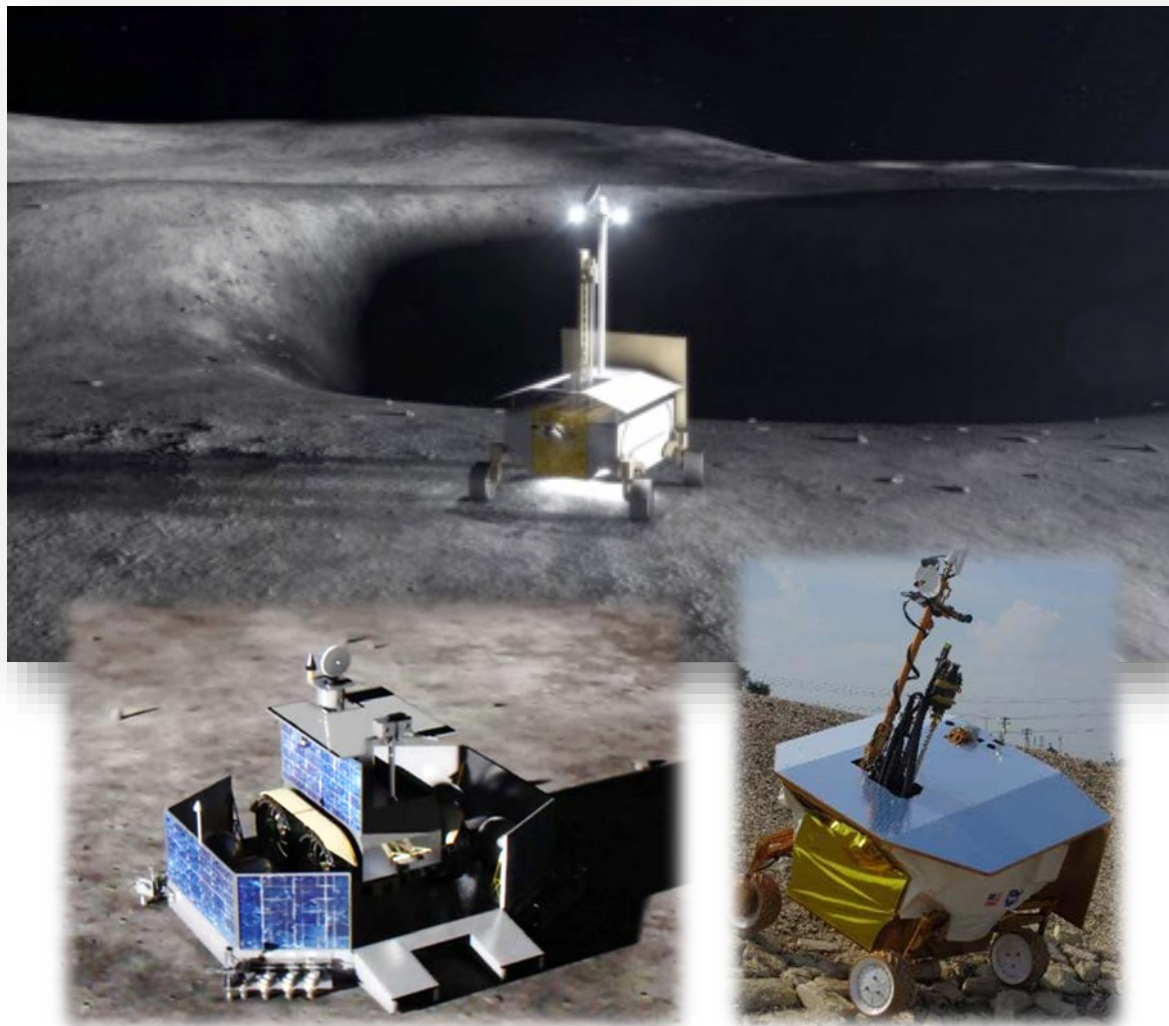


Resource Prospector (RP) Mission

Understand the nature and distribution of water/ices in lunar polar soil

Mission:

- Operate for 6-14 earth days
- Drive into permanently shadowed craters
- Prospect and Drill for Ices
- Determine composition of the Ices and their usability
- Expected Launch in FY21





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Summary

- Ames Research Center leads NASA in Lunar Exploration missions
- NASA Ames is actively developing and operating robotic missions for Lunar and Deep Space Exploration
- NASA Ames actively partners with California's Universities, Companies, and other Government labs to succeed



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Questions?

